

Abstract Submitted  
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**Formation of graphene p-n superlattices on Pb quantum wedged islands**<sup>1</sup> WENGUANG ZHU, HUA CHEN, University of Tennessee & Oak Ridge National Laboratory, KIRK BEVAN, Oak Ridge National Laboratory, ZHENYU ZHANG, Oak Ridge National Laboratory & University of Tennessee — Based on first-principles calculations within density functional theory, we propose a novel scheme to create graphene p-n superlattices on Pb wedged islands with quantum stability. Pb(111) islands grown on vicinal Si(111) extend over several Si steps to form a wedged structure with atomically flat tops. The monolayer thickness variation caused by the underlying substrate steps is a sizeable fraction of the total thickness of the wedged islands and gives rise to a bi-layer oscillation in the Pb(111) work function due to quantum size effect. When a graphene sheet is placed on the surface of such a Pb wedged island, the work-function variations caused by the steps result in an oscillatory shift in the Fermi energy relative to the Dirac point of the graphene. By applying an appropriate external electrical field in the direction perpendicular to the substrate, the Fermi energy of a graphene sheet can be globally tuned to form a well-defined p-n superlattice with potentially intriguing applications in nanoelectronics.

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